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Lucent Technologies Inc.
600 Mountain Avenue
P.O. Box 636
Murray Hill, NJ 07974-0636

EXAMINER

PERILLA, JASON M

ART UNIT

PAPER NUMBER

2634

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5

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/851,858	GOLLAMUDI, SRIDHAR
	Examiner	Art Unit
	Jason M Perilla	2634

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 09 May 2001.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-15, 17-21 and 23-26 is/are rejected.
- 7) Claim(s) 16, 22, 27 and 28 is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 09 May 2001 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>4-5/01</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Claims 1-28 are pending in the instant application.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on May 9, 2001 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Drawings

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the claim limitations describing the matrix multiplications of claims 21-28 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the

changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

4. Claims 1, 2, 4, 8, 11, 15-18, 20, 22, 23, 27, and 28 are objected to because of the following informalities:

Regarding claim 1, the word "where" in line 4 should be stricken.

Regarding claim 2, it is suggested that the claim is amended to read more clearly by replacing "when the conjugate transpose of L is multiplied" of line 2 by --the conjugate transpose of L multiplied--.

Regarding claim 4, it is suggested that the claim is amended to read more clearly by replacing "where $\Phi = L^H L$ is a desired correlation matrix Φ " of line 2 with -- $\Phi = L^H L$, where Φ is a desired correlation matrix--.

Regarding claim 8, the code correlation parameter should be defined as "lambda" to provide clear antecedent basis to lambda of claim 20. Further, claim 8 recites the limitation "the proportion of orthogonal coding" in line 6. There is insufficient antecedent basis for this limitation in the claim. The term "generation" should be replaced by – generating— for clarity of claim language.

Claim 11 recites the limitation "the phase" in line 2. There is insufficient antecedent basis for this limitation in the claim.

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Regarding claims 15 and 16, the use of the limitation including a channel correlation coefficient is objected to because a channel correlation coefficient is not described in the body of the specification.

Regarding claim 17, the use of the limitation including an auto-correlation coefficient is objected to because a channel correlation coefficient is not described in the specification.

Claim 17 recites the limitation "the channel correlation coefficient" in line 1, and "auto-correlation coefficient" in line 2. There is insufficient antecedent basis for these limitations in the claim.

Claim 18 recites the limitation "the forward link transmitter" in line 3. There is insufficient antecedent basis for this limitation in the claim.

Regarding claim 20, the claim is objected to because the product limitation is unclear. The claim provides that each of the symbol signals is the sum of one or more signals each of which is proportional to the product of *one of the incoming symbols and their complex conjugates and their negations and their negations of their complex conjugates*, with a number that is determined by lambda. The claim is written such that the product may be interpreted to be among the incoming symbols and their complex conjugates and their negations and their negations of their complex conjugates rather than one of the above and a number determined by lambda. Further, claim 20 recites the limitation "the symbol signal" in line 1, and "the incoming signals" in line 3. There is insufficient antecedent basis for these limitations in the claim.

Regarding claim 22, "a first complex number" is defined in both lines 4 and 12, and "a second complex number" is defined in both lines 5 and 10. It becomes unclear if the first and second definitions are to be considered the same complex numbers. Further, the claim is objected to because there is no antecedent basis for the claim in the body of the specification.

Regarding claim 23, "a second complex number" is defined in both lines 5 and 10, "a forth signal" is defined in both lines 12 and 17, and "a fifth signal" is defined in both lines 16 and 22. Further, claim 23 recites the limitation "the their complex numbers" in line 24 and "the fifth and sixth" in line 27. There is insufficient antecedent basis for these limitations in the claims. Further, the claim is objected to because there is no antecedent basis for the claim in the body of the specification.

Regarding claim 27, "a first phase" is defined in both lines 4 and 10, and "a second phase is defined in both claims 5 and 9". Further, the claim is objected to because there is no antecedent basis for the claim in the body of the specification.

Regarding claim 28, "a forth signal" is defined in both lines 10 and 14, and "a fifth signal" is defined in both lines 13 and 18. Further, the claim is objected to because there is no antecedent basis for the claim in the body of the specification.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

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6. Claims 6 and 17-19 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Regarding claim 6, the specification discloses that the conjugate transpose of L multiplied by L results in the desired correlation matrix Φ ($\Phi = L^H L$). However, it does not enable that the transformation matrix L is the matrix square root of the desired correlation matrix Φ because the square root of the correlation matrix Φ would not result in the matrix L. The multiplication of a matrix by its own conjugate transpose would not be "negated" by taking the square root of such a result mathematically. Therefore, the generation of the transformation matrix L is not enabled by taking the matrix square root of the desired correlation matrix Φ .

Regarding claim 17, the specification does not describe the generation of the auto-correlation or the auto-correlation coefficient sufficiently enough so that an estimate of it could be made. The claim recites, "the channel correlation coefficient is an estimate of [the] auto-correlation coefficient of channel gain from an antenna for a fixed time delay". However, because one skilled in the art is unable to determine the means to determine the value of the auto-correlation coefficient, one is unable to determine the channel correlation coefficient as an estimate of it.

Regarding claims 18-19, the claims are rejected as being based upon a rejected parent claim.

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. Claims 11-13, 17-19, and 23-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 11, the claim is indefinite because it does not present a clear limitation. One skilled in the art is unable to determine the meaning of "of a real number of the phase". Further, "the phase" of line 2 has no antecedent basis.

Regarding claims 12-13, the claims are rejected as being based upon a rejected parent claim.

Regarding claim 17, the claim is indefinite because one is not able to determine the meaning of "an estimate" in the claim. One is unable to determine the channel correlation coefficient simply as *an estimate* of the auto-correlation coefficient. The proper definition or function of an estimate is not definite in the claim.

Regarding claims 18-19, the claims are rejected as being based upon a rejected parent claim.

Regarding claim 23, the claim is indefinite because the forth component signal does not have an associated complex number or associated complex numbers. Hence, the limitation, "multiplying the forth component signal by the their complex numbers" in line 24 is indefinite because their complex numbers have no definition or distinction.

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Further, the forth component signal is a singular signal and should not be referred to in the plural sense.

Regarding claims 24-25, the claims are rejected as being based upon a rejected parent claim.

Claim Rejections - 35 USC § 102

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. Claim 8, 9, 14, and 15 is rejected under 35 U.S.C. 102(e) as being anticipated by Harrison (US. 6154485 – cited in IDS).

Regarding claim 8, Harrison discloses by figure 1 a method of generating signals for transmitting from at least two antennae of a wireless communications system (abstract) comprising the steps of: feeding a stream of incoming information symbols (TCH; 58) to an encoder (60, 76); feeding a signal representative of a beamforming weight parameter (W0, W1) to the encoder to modify the stream of information symbols; feeding a code correlation parameter (fig. 5; a) to the encoder to control the proportion of orthogonal coding relative to beamforming of the stream of information symbols that are to be transmitted (fig. 5; col. 8, lines 5-35) ; and feeding the stream of information symbols modified by the code correlation parameter to at least two antennae for transmission (116, 118). The spreading codes W0 and W1 (col. 3, lines 12-18) are considered beamforming weight parameters because they differentiate or weight and modify the information signals. Further, the adaptive array processor (76) of figure 1,

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which is considered to be part of the signal encoder, may be implemented by the matrix multiplication of figure 5 (col. 5, lines 10-18). The encoder embodiment of figure 5 must necessarily be "fed" the code correlation parameter α because it is used as input to the multipliers 172 and 176.

Regarding claim 9, Harrison discloses the limitations of claim 8 as applied above. Further, Harrison discloses that the code correlation parameter determines the correlation of the encoded signals to the different antennae (fig. 5). The multiplication blocks 172 and 176 are responsive to the code correlation parameter α according to the evaluation $(1 - \alpha^2)^{1/2}$. Therefore, the encoded signals are thereby responsive to the different antennae (connected to 94 and 96) according to the code correlation parameter α .

Regarding claim 14, Harrison discloses the limitations of claim 9 as applied above. Further, Harrison discloses a duplex communication system having a forward and reverse link (fig. 1; col. 4, lines 28-38) and that the code correlation parameter is determined from signals received on the reverse link (col. 4, line 64 – col. 5, line 17). Harrison discloses that the adaptive array weights (90 and 92) are computed according to the feedback (col. 5, line 68 – col. 6, line 6). Furthermore, in the adaptive array encoder embodiment of figure 5, the adaptive array weights are embodied as the code correlation parameter α (col. 7, lines 47-60) which is thereby responsive to the feedback of communications method (col. 8, lines 5-35).

Regarding claim 15, Harrison discloses the limitations of claim 14 as applied above. Further, Harrison discloses the step of determining traffic channel data on the

reverse link (col. 6, lines 1-7) which is used to control the code correlation parameter as applied to claim 14 above. As broadly as claimed, it is obvious that the channel data is used to determine "a channel correlation coefficient" from the signals received on the reverse link. Because the data is used to adjust the amount of adaptive beamforming on the side of the transmitter, channel correlation according the feedback must be performed for the beamforming to be adapted.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 1, 2, 4, 5 rejected under 35 U.S.C. 103(a) as being unpatentable over Harrison.

Regarding claim 1, Harrison discloses a method of encoding information symbols for multiple antennae transmission (abstract) comprising the steps of: generating a code matrix B_0 or parallel traffic channels (fig. 1, refs. 64, and 66; col. 3, lines 8-12); generating a transformation matrix L (fig. 5; col. 7, lines 40-60); and combining the code matrix B_0 with the transformation matrix L to obtain a result B for controlling the amount of beamforming relative to the amount of orthogonal coding in signals transmitted from the multiple antennae (fig. 5; col. 8, lines 5-35). Figure 1 shows the code matrix channels 64 and 66 which are output as 72 and 74. Figure 5 represents the realization of the combination of transformation matrix L by the code matrix (72 and 74). Although

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the transformation matrix is not explicitly disclosed in matrix form, it is obvious that the combination illustrated in figure 5 depicts the transformation matrix comprising elements $(1 - \alpha^2)^{1/2}$ combined with the code matrix. The term alpha (α) is used to control the amount of beamforming relative the amount of orthogonal coding in the output of the combination (col. 8, lines 5-35).

Regarding claim 2, Harrison discloses the limitations of claim 1 as applied above. Further, as broadly as claimed, the transformation matrix L is a matrix such that the conjugate transpose of L multiplied by L generates a correlation matrix Φ . Because no limitations are implied for the value of the correlation matrix in the claims or the specification, it is understood that the matrix L multiplied by the conjugate transpose of the matrix L would sufficiently result in the correlation matrix as broadly as claimed.

Regarding claim 4, Harrison discloses the limitations of claim 4 as applied to claims 1 and 2 above.

Regarding claim 5, Harrison discloses the limitations of claim 4 as applied above. Further, Harrison discloses the desired correlation parameter α (equivalent to λ of the instant application). Alpha is used to control the amount of beamforming relative the amount of orthogonal coding in the output of the combination (col. 8, lines 5-35). According to figure 5, the transformation matrix and hence the correlation matrix is comprised of alpha.

12. Claims 3, 7, and 20 rejected under 35 U.S.C. 103(a) as being unpatentable over Harrison in view of Alamouti et al (US 6185258 – cited in IDS; hereafter “Alamouti”).

Regarding claim 3, Harrison discloses the limitations of claim 1 as applied above. Harrison does not explicitly disclose that the code matrix B_0 is orthogonal although orthogonal transmit diversity is utilized (col. 1, lines 45-57; col. 8, lines 4-12). However, Alamouti discloses the generation of an orthogonal code matrix for transmission of data over two or more antennas (abstract). An orthogonal code matrix is disclosed in table 1 as the outputs of antenna 1 and 2 over the time periods t and $t+T$ (col. 4, line 20). Alamouti discloses that the use of orthogonal coding results in space, time and frequency diversity (col. 2, lines 50-55). Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize an orthogonal code matrix as disclosed by Alamouti in the encoding method of Harrison because it would allow for space, time and frequency diversity. Further, the use of an orthogonal code matrix is obvious in view of Harrison alone because in the case that $\alpha = 0$, orthogonal transmit diversity mode is solely enabled (col. 8, lines 5-12).

Regarding claim 7, Harrison discloses the limitations of claim 7 as applied above. Harrison does not explicitly disclose that the code matrix B_0 is generated by encoding symbols of a serial data stream with orthogonal code to generate an orthogonal code matrix B_0 although orthogonal transmit diversity is utilized (col. 1, lines 45-57; col. 8, lines 4-12). However, Alamouti discloses the generation of an orthogonal code matrix for transmission of data over two or more antennas (abstract). An orthogonal code matrix is disclosed in table 1 as the outputs of antenna 1 and 2 over the time periods t and $t+T$ (col. 4, line 20). The matrix is generated by encoding the symbols s_0 and s_1 of a serial data stream by an orthogonal code as shown in the result of table 1. Alamouti

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discloses that the use of orthogonal coding results in space, time and frequency diversity (col. 2, lines 50-55). Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize an orthogonal code to generate the code matrix B_0 as disclosed by Alamouti in the encoding method of Harrison because it would allow for space, time and frequency diversity. Further, the use of an orthogonal code matrix is obvious in view of Harrison alone because in the case that $\alpha = 0$, orthogonal transmit diversity mode is solely enabled (col. 8, lines 5-12).

Regarding claim 20, Harrison discloses the limitations of claim 8 as applied above. Harrison does not explicitly disclose that the stream of incoming signals is orthogonal although orthogonal transmit diversity is utilized (col. 1, lines 45-57; col. 8, lines 4-12). However, Alamouti discloses the generation of an orthogonal code matrix for transmission of data over two or more antennas (abstract). An orthogonal code matrix is disclosed in table 1 as the outputs of antenna 1 and 2 over the time periods t and $t+T$ (col. 4, line 20). Alamouti discloses that the use of orthogonal coding results in space, time and frequency diversity (col. 2, lines 50-55). Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize an orthogonal code matrix and orthogonal symbols as input to the encoder as disclosed by Alamouti in the encoding method of Harrison because it would allow for space, time and frequency diversity. Further, the use of an orthogonal code matrix is obvious in view of Harrison alone because in the case that $\alpha = 0$, orthogonal transmit diversity mode is solely enabled (col. 8, lines 5-12). Thereby, Harrison discloses that the symbol signal transmitted by each antenna at each symbol time is the sum of one or

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more signals (fig. 5), each of which is proportional to the product of one of the incoming symbols (72) and their complex conjugates (74) with a number that is determined by lambda or alpha (α). With orthogonal code as the input to the encoder embodiment (fig. 5) of Harrison, the symbol output (94) would be a composition or product of one incoming signal (72) with their complex conjugate (74) with a number that is determined by alpha (172 and 176; $(1 - \alpha^2)^{1/2}$).

13. Claim 10 rejected under 35 U.S.C. 103(a) as being unpatentable over Harrison in view of Dabak et al (US 6594473; hereafter "Dabak").

Regarding claim 10, Harrison discloses the limitations of claim 9 as applied above. Harrison discloses beamforming weight codes W0 and W1 being applied to the information symbols, but does not disclose that they are complex representing a magnitude and a phase. However, Dabak discloses a multiple antenna transmission method by figure 4 which uses complex beamforming weight parameters having magnitude and phase (fig. 4, refs. W1 and W2). The beamforming weight parameters are utilized by the closed loop communications system to advantageously modify the beam outputs from the transmitter (col. 3, lines 10-23; col. 4, lines 5-10; col. 4, lines 45-50; col. 5, lines 5-30). Dabak discloses the method of generating the values of the weights and it is obvious that the weights have a complex value due to the complex notation of the equations used (col. 10, line 12 – col. 12, line 25). Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize complex adaptive beamforming weight parameters according to the closed loop response of the communications method as taught by Dabak in the

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communications method of Harrison because it could be responsive to feedback information and adjust the beamform transmission accordingly. It is well known in the art that a complex number represents one having magnitude and phase.

14. Claim 21 and 26 rejected under 35 U.S.C. 103(a) as being unpatentable over Karabinis (US 4780884).

Regarding claim 21, Karabinis discloses by figure 1 a method of forming a signal comprising the steps of: obtaining at least two component signals (135 and 136); multiplying a first component signal (135) by a first complex number (127) to obtain a first signal (output of 127); multiplying a second component signal (136) by a second complex number (128) to obtain a second signal (output of 128); wherein the phases of the first and second complex numbers are unequal (129); and subtracting (130) the second signal from the first signal to obtain a first composite signal for transmission by a first antenna element during a first transmit period (105). Karabinis obtains two component signals 135 and 136 from the data signal 120 and outputs them by the two D/A converters 122 and 123. Further, it is obvious to one of ordinary skill in the art that the output of the oscillator 126 may be represented by a complex number because complex numbers are generally used in the art to define the magnitude and phase of a signal in phasor notation. The phase shift block 129 phase alters the first complex number to create a second complex number which therefore has a phase shift with respect to the first complex number. The first component signal is multiplied with the first complex number at node 127 (first signal) and the second component signal is

multiplied with the second complex number at node 128 (second signal). Finally, the second signal is subtracted from the first signal at the subtracting block 130.

Regarding claim 26, Karabinis discloses the limitations of the claim as applied to claim 21 above.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following prior art of record not relied upon above is cited to further show the state of the art with respect to orthogonal coding and adaptive beamforming.

U.S. Pat. No. 6317410 to Allpress et al.

U.S. Pat. No. 6661856 to Calderbank et al.

U.S. Pat. No. 6587515 to Jafarkhani et al.

U.S. Pat. No. 6754286 to Hottinen et al.

U.S. Pat. No. 6178196 to Naguib et al.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M Perilla whose telephone number is (703) 305-0374. The examiner can normally be reached on M-F 8-5 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Chin can be reached on (703) 305-4714. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Jason M. Perilla
August 3, 2004

jmp



CHIEH M. FAN
PRIMARY EXAMINER